alous origin at an outside institution and has been lost to F/U. All pts s/p unroofing are asymptomatic with patent coronary flow by Doppler and normal/improved LV function at F/U; aortic insufficiency is mild in 1 (with bicuspid Ao valve), trivial in 1, and none in 3 pts. *Conclusion*: AOCA is frequently characterized by an intramural course which can be prospectively identified by TTE. The intramural form of AOCA can be reliably repaired by unroofing the intramural segment without bypass grafting. We speculate that early TTE identification and aggressive surgical intervention can be life-saving in pts with this rare anomaly.

1167-99 Noninvasive Method for Quantification of Aortopulmonary Collateral Flow In Bi-Directional Glenn Shunts

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Background: Aortopulmonary collateral flow (APCF) is a significant risk factor for the success of Fontan Surgery. It is estimated qualitatively on the pre-Fontan cardiac catheterization (CC). No method to quantify the APCF exists. This study assesses feasibility of quantitative assessment of APCF using radionuclide technique in patients (pts) with a Bidirectional Glenn Shunt(BDG).
Methods: We prospectively studied 20 pts with a BDG shunt who were undergoing a pre-Fontan evaluation by CC. Pts with non-BDG sources of pulmonary blood flow, were excluded. Tc-99m MAA (albumin aggregates) was injected into a lower extremity vein. Injected activity would return via the inferior vena cava into the heart, and then to the systemic circulation. If any APCs exist, it would be reflected by the counts in the lungs. The ratio of activity in the lungs to the total body activity would signify %APCF. Two independent blinded observers assessed APCF on angiogram qualitatively and graded the amount of APCF as none, small, moderate or large. The quantitative data obtained by the scan was compared to the qualitative assessment.
Results: The %APCF obtained by the scan ranged from a minimum of 8% to a maximum of 54%. In one pt with minimal (8%) APCF and the one with large (54%) APCF, there was excellent correlation with qualitative assessment by both the reviewers. There were 13 pts with %APCF ranging from 19% to 39% (median 31%).This correlated with a median grade of moderate APCF by qualitative assessment.There was significant inter-observer variability in the qualitative assessment of the group with shunt between 19%-39%, r=0.4, p<0.01.There were 6 pts with >40% APCF, 4 had moderate to large and 2 had small APCF by qualitative assessment, (r=0.37).
Conclusions: Tc-99m MAA scan is a noninvasive method that can quantify APCF. This techchnique complements the qualitative assessment of APCF and thereby can possibly aid risk stratification for the Fontan surgery.

1167-100 The Diagnostic Yield of Echocardiographic Testing In Pediatric Patients With Chest Pain

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Background: Chest pain is an unusual manifestation of cardiac disease in the pediatric population, although it is a frequent cause for referral to the pediatric cardiologist. The primary care physician and pediatric cardiologist frequently obtain an echo in the evaluation of these patients. However, the diagnostic yield of this approach is unknown.
Methods: Our echo laboratory database was queried for all patients undergoing an echo for the complaint of chest pain from 7/1/95 to 9/1/01. Patients with known congenital or acquired heart disease were excluded from the study. Ordering physician, reason for study, echo diagnosis and patient demographics were reviewed.
Results: A total of 407 studies in 393 patients (55% male; 45% female) were identified. The patients ranged in age from 4-21 years old (mean 13 years). The 407 studies represented 1.4% of the total echo lab volume. The ordering physician was a pediatric cardiologist in 99/407 studies (24%). Although chest pain was the primary reason for echo evaluation, additional reasons based on clinical findings were specified in 49% (suspected mitral valve prolapse (MVP) (15%), abnormal ECG (5.4%), association with exercise (3.4%), syncope (3.4%), shortness of breath (3.7%), suspected cardiomyopathy (3.7%), palpitations (3.2%), suspected pericarditis (3.2%), suspected valver disease (2%), and other (6.1%)). Pathology was identified in only 39 patients (10%) and consisted of MVP (2%), patent foramen ovale (2%), left ventricular hypertrophy (1%), atrial septal defect (1%), bicuspid aortic valve (0.7%), patent ductus arteriosus (0.2%), pericardial effusion (0.2%) and other (2%). No patients were found to have hypertrophic cardiomyopathy or coronary artery anomalies.
Conclusions: Physicians infrequently suspect significant pathology but obtain echos to detect occult disease not apparent by history or physical examination. However, the diagnostic yield of an echo in the evaluation of pediatric chest pain is low. Patients with no known preceding cardiac history may benefit from a cardiac consultation to avoid unnecessary echos. These data may be useful for the development of cost-effective strategies in the evaluation of pediatric chest pain.

1167-101 MRI Evaluation of Cardiac Tumor Characteristics in Infants and Children

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Background: Most childhood cardiac tumors are diagnosed by echocardiography but specific tumor type and extent may not be completely delineated. This study investigates the role of MRI tissue characterization in childhood cardiac tumors.
Methods: MRI, echo, cath, surgical, clinical, and pathology data of 10 pts (age 1 day-11.4 yrs) evaluated by MRI for cardiac tumors were reviewed. T1 standard spin echo (SSE) or fast spin echo (FSE) with double inversion recovery (DIR) were the primary MRI sequences used to assess tumor morphology (n=10). T2 FSE was used for distinguishing vascular or cystic tumors (n=5), and post-gadolinium FSE with DIR for assessing tumor vascularity (n=4). Cine MRI with/without tissue tagging was used for evaluating myocardial motion (n=8).
Results: T1 SSE and FSE with DIR clearly identified tumor location and borders in all pts. MRI correctly predicted tumor type in all 7 pts who had a histologic diagnosis available (table).

Tumor	N	T1 weighted*	T2 weighted*	Post-Gd T1vascularity
Fibroma	2	iso-hypointense	iso-hypointense	decreased
Hemangioma	2	isointense	hyperintense	increased
Rhabdomyoma	1	iso-hypointense	iso-hypointense	decreased
Purkinje cell tumor	1	hyperintense	hypointense	not performed
Pericardial teratoma	1	hypointense	not performed	decreased

* compared to adjacent uninvolved myocardium

Of the 3 pts without histology, 2 presented with arrhythmia and were found by MRI to have fatty tumors (1 septal, 1 right AV groove) and 1 pt had multiple rhabdomyomas. MRI was followed by tumor resection in 5 pts, open biopsy in 2, antiarrhythmic medications in 1, and no treatment in 2.
Conclusions: MRI clearly identifies tumor location and borders, and provides additional information on tumor tissue characteristics that, in this cohort, proved helpful in clinical management.

1167-102 Three-Dimensional Free-Breathing Pediatric Cardiovascular Magnetic Resonance Imaging With Real-Time Navigator Respiratory Synchronization

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Background: Respiratory motion causes many artifacts in cardiovascular magnetic resonance (CMR) studies performed in free-breathing pediatric patients. Breath-holding CMR is impractical in many of these patients. A real-time navigator (NAV) technique, which continuously tracks the diaphragm and synchronizes data acquisition with the respiratory cycle, is an alternative to breath-holding and has been demonstrated to have utility in adult patients. Purpose: To evaluate a real-time NAV method for CMR in pediatric patients. Methods: Thirty free-breathing pediatric patients with known or suspected cardiovascular disease were evaluated with three-dimensional turbo field echo CMR acquisitions enhanced by real-time motion-corrected NAV gating. Acquisitions were synchronized with the cardiac cycle by a vectorcardiographic technique. Data was obtained in late diastole by adjusting the acquisition delay appropriately for heart rate. The NAV gating window was optimized for patient size. Twelve patients were sedated. Patients included two with pulmonary atresia, one with transposition of the great arteries, two with tetralogy of Fallot, three with Kawasaki disease, two with secundum atrial septal defects, three with anomalous pulmonary veins, one with supravalvar aortic stenosis, two with coarctation and twelve with exercise induced syncope/arrhythmia. Results: Good quality images were obtained in all patients. The NAV technique provided superior delineation of coronary artery branching in comparison to CMR acquisitions obtained without respiratory synchronization. Additionally, images of the proximal pulmonary arteries, pulmonary veins, and inferior atrial septum acquired with the NAV compared favorably to images made without respiratory synchronization. The vectorcardiographic synchronization of the cardiac cycle substantially assisted in eliminating erroneous T-wave triggering. Conclusions: CMR acquisition with the real-time NAV technique is a promising method in free-breathing pediatric patients. The use of this method is not limited to coronary artery imaging. Indeed, it is helpful for imaging a variety of different cardiovascular structures.

POSTER SESSION

1190 Advances in Pediatric Cardiac Catheterization

Tuesday, March 19, 2002, Noon-2:00 p.m.
Georgia World Congress Center, Hall G
Presentation Hour: 1:00 p.m.-2:00 p.m.

1190-97 Endovascular Stent Implantation In Patients With Stenotic Aorto-Arteriopathies: Early and Medium-Term Results

Ernest S. Siwik, James E. Lock, Stanton B. Perry, *Rainbow Babies and Children's Hospital/Case Western Reserve University, Cleveland, Ohio, Children's Hospital/Harvard University, Boston, Massachusetts.*

Background: Data regarding outcome of stent implantation for stenotic aorto-arteriopathy (SAA) is incomplete. Given the vessel wall abnormalities, it is uncertain whether response to stent implantation differs from more common indications such as isolated aortic coarctation. We report on the results for patients with SAA who underwent arterial stent implant during 1989-2000. **Methods:** Procedural indications, short- and medium-term results, and complications for patients with SAA were reviewed. **Results:** Nine patients, at a median age of 14 years of age, underwent 11 procedures. A total of 21 stents were implanted in the thoracic aorta, abdominal aorta, and brachiocephalic vessels. Five patients had diffuse arterial disease, three patients had findings consistent with middle aortic syndrome, and one patient had both thoracic and abdominal coarctation. Associated diagnoses included Williams syndrome (2), neurofibromatosis (2), Takayasu's (1), and congenital rubella (1). Median gradient prior to intervention was 60 mm

Hg (20-140 mm Hg). Immediate post-stent gradient was 15 mm Hg (0-60 mm Hg, p<.001). Median follow-up was 39 months (12-78 months). Seven patients had repeat study. Additional stents were implanted in 2 patients and 5 underwent stent re-dilation. At re-study, median gradient was 37 mm Hg (10-55 mm Hg), with post-dilation gradient of 12 mm Hg (0-40 mm Hg). Two procedure-related complications were noted. One stent was deployed in the femoral artery after dislodging during implantation. At restudy, one patient was found to have developed multiple aneurysms adjacent to stents implanted in the thoracic aorta and brachiocephalic vessels. **Conclusions:** Stent implantation is effective in providing gradient relief in SAA. Early procedure related complications are uncommon and gradient relief persists or is amenable to re-dilation. Uncomplicated stent implantation does not preclude aneurysm formation, however. This complication may be related to histopathologic and vessel wall-specific issues, making prediction of which patients are at risk difficult.

1190-98 Transcatheter Aortic Valvuloplasty Assisted by Right Ventricular Pacing

Frank F. Ing, Nicole K. Boramanand, James Mathewson, Kathleen Maginot, James C. Perry, *Children's Hospital of San Diego, San Diego, California, UCSD, School of Medicine, San Diego, California.*

Background: Transcatheter aortic valvuloplasty (TAV) is a well-established treatment modality for congenital aortic valve stenosis. However during dilation, inadvertent balloon movement (due to the contractile force of the left ventricle) can increase risk of unnecessary trauma to the aortic valve apparatus resulting in aortic insufficiency (AI). A new technique was developed to stabilize balloon position during dilation. Methods: Standard transfemoral retrograde techniques were used for TAV. A pacing catheter was inserted into the right ventricle (RV) apex and just prior to balloon inflation, the heart was paced at a faster rate in order to decrease the stroke volume and left ventricle (LV) systolic pressure. The lower LV stroke volume and systolic pressure result in a more stable balloon position. Balloon inflation was carried out in the usual manner and following balloon deflation, RV pacing was discontinued. Echocardiographic and cath lab data were reviewed in all patients who underwent TAV assisted by RV pacing between 9/99 and 8/01. Results: Thirteen patients underwent TAV assisted by RV pacing (31 inflations). Mean age and weight were 9.9 years and 31.7 kg respectively. The aortic valve gradient decreased from 67.8 ± 18.6 to 19.4 ± 9.1 mmHg (75%). The average balloon to annulus ratio was 0.92 ± 0.08. RV pacing increased the heart rate by an average of 80 ± 29% and decreased LV systolic pressure by 36 ± 12%. Balloon position remained stable during inflation in all except for one when there was loss of capture resulting in a premature ventricular contraction (PVC). Review of the fluoroscopic and hemodynamic recording of that inflation indicated the balloon "milked" forward during the PVC. Normal sinus rhythm returned in all cases immediately after RV pacing was discontinued. No change in AI or trace AI was seen in 10 pts. The development of mild AI was seen in 3 (1+ in 1 and 2+ in 2 pts). Conclusion: RV pacing during TAV is safe and stabilizes balloon position during aortic valve dilation. Larger series and longer follow-up are warranted to confirm that stable balloon position during TAV decreases the incidence of aortic insufficiency.

1190-99 Intracardiac Echocardiography During Interventional Catheterization for Congenital Heart Defects

John F. Rhodes, Jr., Tamar J. Preminger, Cesar I. Mesia, Geoffrey K. Lane, Lourdes R. Prieto, Larry A. Latson, *The Cleveland Clinic Foundation, Cleveland, Ohio.*

Background: Echocardiographic guidance is often used during transcatheter interventions for patients with congenital heart defects. Few data exist regarding intracardiac echocardiographic (ICE) guidance during transcatheter interventions. We report data from a single center regarding the efficacy and performance of ICE for this patient population. **Methods:** The 10Fr AcuNav™ ICE catheter provides a 2-dimensional image and Doppler color mapping using the Sequoia ultrasound system. Between 5/01 and 9/01, data were collected prospectively from patients undergoing interventional procedures using ICE and conscious sedation. The ICE catheter was positioned through an 11Fr sheath in the right atrium. **Results:** Seventeen patients, median age 48 years (range 12 to 77), underwent a transcatheter intervention for a congenital heart defect with ICE guidance. Twelve patients underwent patent foramen ovale (PFO) closure, two patients atrial septal defect (ASD) closure and three patients balloon aortic valvuloplasty (BAV). ICE allowed the patients to avoid general anesthesia and transesophageal echocardiography (TEE). ICE provided accurate monitoring for placement of devices during PFO/ASD closure and degree of valvar regurgitation during BAV. There were no procedure related adverse events. The median fluoroscopy time for PFO/ASD closure was 17 minutes (range 11 to 36) and for BAV procedures was 30 minutes (range 21 to 68). Overall billable charges were less for the ICE group when compared to the potential charges of the procedure including general anesthesia and TEE. All patients were discharged <24 hours following the catheterization. With a median follow-up of 2.4 months (range 0.7 to 3.8) there have been no adverse events. **Conclusion:** ICE is a safe and effective method for guidance during interventional procedures for patients with congenital heart defects. The avoidance of general anesthesia and TEE may be significant to the patients overall procedural experience and be more cost effective. These data support continued utilization of this type of technology.

1190-100 Intermediate Follow-Up for Atrial Septal Defect Closure With the HELEX™ Septal Occluder Device: The FDA Phase I Feasibility Trial

John F. Rhodes, Jr., Geoffrey K. Lane, David Nykanen, Penny A. Radvansky, Evan M. Zahn, Larry A. Latson, *The Cleveland Clinic Foundation, Cleveland, Ohio, Miami Children's Hospital, Miami, Florida.*

Background: The Helex™ device has recently been used for transcatheter secundum atrial septal defect (ASD) closure. We report the intermediate follow-up data regarding device safety and performance. **Methods:** Between 4/00-12/00, pts with an ASD in two centers were enrolled in a prospective, non-randomized FDA phase-I feasibility trial. Catheterizations were performed using general anesthesia with transesophageal echocardiography guidance. Procedural success was defined as accurate placement of a device. Evaluations were scheduled for 1-day, 1-month, 6-months and 1-year following deployment. **Results:** Fifty-five pts with an ASD, median age 10yrs (range 0.4 to 55), proceeded to the catheterization laboratory. Static balloon-stretched ASD diameter was 7.1→26mm (17±4.4). Device/balloon waist ratio was 1.3→4.2 (1.8±0.5). The procedure was successful in 50 pts. There were 7 procedure-related adverse events with device embolization (uneventful retrieval) in 2-pts, transient arrhythmia in 3-pts and transient ST depression in 2-pts. Median fluoroscopy time was 23 minutes. No adverse event prolonged the hospitalization. No pt had a clinically significant residual leak around the device. The incidence of trivial/small leaks has decreased from 27/50 (54%) at 1-day to 22/47 (47%) at 1-month and 9/30 (30%) at 6-months. At this time, 1-year follow-up is available in 15 pts with 2 (13%) having a trivial/small leak around the device and one having a small residual shunt through a second ASD. The only adverse events reported during follow-up have been 1-pt with nosebleed and 1-pt with rectal bleeding. Both resolved with a decrease in the standard aspirin anticoagulation regimen. Although no pt has had new onset documented arrhythmia, 2-pts have had complaints of palpitations and 2-pts have had return of atrial arrhythmia after implantation. With a median follow-up of 210 days (range 27 to 358) there have been no device fractures. **Conclusion:** These intermediate data indicate that the Helex™ device is safe and effective for secundum-ASD closure. At latest follow-up no pt has a clinically significant residual leak and the incidence of clinically insignificant leak appears to decrease.

1190-101 Amplatzer Fenestration Device: Application in Humans to Maintain Patency of Fontan Fenestration and Shunt Through the Atrial Septum

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Background: Patients who develop systemic venous failure and protein-losing enteropathy after lateral tunnel or extracardiac Fontan, may benefit from fenestration created between the systemic and pulmonary venous channels. Some fenestrations, whether created surgically or in the catheterization laboratory, tend to close spontaneously. In addition, patients with pulmonary hypertension or ventricular dysfunction and atrial septal defect may benefit from a small communication at the atrial level, if the defect is closed. The objective of this study was to assess the feasiblity of a new Amplatzer device, to maintain patency of Fontan Fenestration and atrial level communication, after closure of the atrial septal defect. ***Methods:*** Amplatzer Septal Occluder® was modified to create a 4-mm fenestration through the discs and the waist of the device. The basic design, loading, delivery, deployment and release mechanism were similar Amplatzer Septal Occluder. Three patients with protein-losing enteropathy after Fontan operation, underwent placement of the device. A fenestration was created in the Goretex patch of the lateral tunnel with the help of transseptal needle. The fenestration was dilated with 8-mm balloon, and the 4-mm Fenestration device (8-mm disc) was deployed under transesophageal echocardiographic guidance. The fourth patient, who had ventricular dysfunction, had the device placed in the atrial septal defect. ***Results:*** The procedure was successful in all patients. There was immediate drop in systemic arterial saturations and systemic venous pressures after placement of the device. All patient showed dramatic hemodynamic improvement. Follow-up was available from 3 to 12 months. Echocardiographic evaluation at the last follow-up revealed low velocity flow through the fenestrations. ***Conclusions:*** This limited experience suggest that the Amplatzer Fenestration device can be a valuable tool in keeping Fontan Fenestrations patent. It can also maintain a communication at the atrial level in patients with pulmonary hypertension or ventricular dysfunction after atrial septal defect closure.

1190-102 Quantitative Angiographic Assessment of Pulmonary Blood Flow In Children With Congenital Heart Defects

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Background: This study was performed to validate a new method of quantifying relative pulmonary blood flow by angiography.

Methods: Pulmonary angiograms and radionuclide lung perfusion scans (LPS) of 12 children with various congenital heart malformations were compared. Relative blood flow to the left and right lung was measured by pulmonary angiographic densitometry (AD) using a new image analysis protocol. Perfused regions of the left and right lung were defined and the cross-sectional area and mean contrast density in each region of interest was quantitated. The ratio of right pulmonary artery flow to total lung flow was determined by AD, expressed as a percent (Qp_{AD}), and was compared to the ratio of right pulmonary flow as determined by LPS (Qp_{LPS}). Observers blinded to the LPS data performed the AD measurements, and intraobserver and interobserver variability was determined.

Results: The Qp_{AD} ranged from 15-100% (mean +/- SD = 52 +/- 26), and the Qp_{LPS} ranged from 17-97% (57+/- 26). There was a significant linear relation between Qp_{AD}